

WHAT IS CLAIMED IS:

1 1. A large area data storage system comprising:
2 a first storage sub-system located in a first data center, comprising a first
3 computer system configured to receive storage access requests from one or more user
4 systems and to process the storage access requests and a first data storage system operative
5 with the first computer system to satisfy received storage requests, the first data storage
6 system comprising a plurality of data volumes including a primary volume and a primary
7 difference volume;
8 a second storage sub-system located in a second data center; and
9 a third sub-system located in a third data center, comprising a second
10 computer system and a second data storage system operative with the second computer
11 system , the second data storage system comprising a plurality of data volumes including a
12 secondary volume and a secondary difference volume,
13 the first and second storage sub-systems each configured to synchronously
14 transmit data to the second storage sub-system,
15 the first data storage system configured to perform steps of storing data
16 received from the first computer system to the primary volume and communicating blocks of
17 data from the primary volume to the second data storage system, and in response to receiving
18 a first command from the first computer system:
19 selectively storing subsequent data received from the first computer
20 system to the primary difference volume;
21 communicating blocks of data from the primary volume to the second
22 data storage system; and
23 upon completing the step of communicating blocks of data,
24 communicating a first signal to the second data storage system,
25 the second data storage system configured to perform steps of storing data
26 received from the first data storage system to the secondary difference volume, and in
27 response to receiving the first signal, copying data contained in the secondary difference
28 volume to the secondary volume.

1 2. The data system of claim 1 wherein the second sub-system is
2 configured to perform, in response to the first sub-system becoming unavailable, a takeover
3 operation and a data transfer state inquiry of the third sub-system.

1 3. The data system of claim 2, wherein a transfer state bit map is provided
2 in each of the second sub-system and the third sub-system, wherein a response to the data
3 transfer state inquiry is based on the transfer state bit maps.